CALIBRATION STANDARD REQUIREMENT

FOR A

PORTABLE LOW PRESSURE CALIBRATOR

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PROCUREMENT PACKAGE

Prepared by: Naval Warfare Assessment Division
Measurement Science Directorate
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1. SCOPE

1.1 Scope. This requirement defines the mechanical, electrical, and electronic characteristics for a Portable Low Pressure Calibrator. This equipment is intended to be used by Navy personnel in shipboard and shorebased laboratories to provide calibration support for general purpose pressure measuring instruments. For the purposes of this requirement, the Portable Low Pressure Calibrator shall be referred to as the PLPC.

1.1.2 Design and Capability. The PLPC shall employ a standard differential capacitance pressure sensor mounted on a thermal base to ensure the utmost in temperature stability.

1.2 PLPC System. Contained within the PLPC are the 10 kHz carrier supply, stabilized DC power, the signal range switch and amplifier, the phase sensitive demodulator, and output amplifier, as shown in Figure 1.

2. APPLICABLE DOCUMENTS

2.1 Controlling Specifications. MIL-T-28800, “Military Specification, Test Equipment for use with Electrical and Electronic Equipment, General specification for,” and all documents referenced therein of the issues in effect on the date of this solicitation shall form a part of this specification.

3. REQUIREMENTS

3.1 General. The PLPC shall conform to the Type II, Class 5, Style E requirements as specified in MIL-T-28800 for Navy shipboard and shorebased use as modified below. The use of material restricted for Navy use shall be governed by MIL-T-28800.

3.1.1 Design and Construction. The PLPC design and construction shall meet the requirements of MIL-T-28800 for Type II equipment.

3.1.2 Power Requirements. Each major assembly shall operate from a source of 103.5V to 126.5V at 50 Hz and 60 Hz ± 5% single-phase, 10 Amp input power, except that one major assembly may derive power from the other.

3.1.2.1 Fuses or Circuit Breakers. Fuses on circuit breakers shall be provided. If circuit breakers are used, both sides of the power source shall be automatically disconnected from the equipment in the event of excessive current. If fuses are used, only the line side of the input power line, as defined by MIL-C-

28777, shall be fused. Fuses or circuit breakers shall be readily accessible.

3.1.2.2 Power Connection. The requirements for power source connections shall be in accordance with MIL-T-28800 with a 6-foot minimum length cord.

3.1.3 Dimensions and Weight. Maximum dimensions shall not exceed 20 inches in width, 12 inches in height, and 20 inches in depth. The PLPC weight shall not exceed 27 pounds.

3.1.4 Lithium Batteries. Per MIL-T-28800, lithium batteries are prohibited without prior authorization. A request for approval for the use of lithium batteries, including those encapsulated in integrated circuits, shall be submitted to the procuring activity at the time of submission of proposals. Approval shall apply only to the specific model proposed.

3.2 Environmental Requirements. The PLPC shall meet the environmental requirements for a Type II, Class 5, Style E equipment with the deviations specified below.

3.2.1 Temperature and Humidity. The PLPC shall meet the conditions below:

	Temperature (°C)	Relative Humidity (%)
Operating	10 to 30	95
	30 to 40	75
Non-operating	-40 to 70	Not Controlled

3.2.2 Electromagnetic Compatibility. The electromagnetic compatibility requirements of MIL-T-28800 are limited to the following areas: CE01, CE03, CS02, CS02, CS06, RE01, RE02 (14 kHz to 1 Ghz), and RS03.

3.3 Reliability. Type II reliability requirements are as specified in MIL-T-28800.

3.3.1 Calibration Interval. The PLPC shall have an 85% or greater probability of remaining within tolerances of all requirements at the end of a 12 month period.

3.4 Maintainability. The PLPC shall meet the Type II maintainability requirements as specified in MIL-T-28800 except the lowest discrete component shall be defined as a replaceable assembly. Certification time shall not exceed 60 minutes.

3.5 Performance Requirements. The PLPC shall provide the following capability as specified below. Unless otherwise

indicated, all requirements shall be met following a 30-minute warm-up period.

3.5.1 Pressure Transducer. The PLPC shall meet the following pressure transducer requirements.

3.5.1.1 Pressure Transducer Range. The PLPC shall provide the following full scale pressure ranges available by turning one convenient control switch.

0 to + 100.00 psig
0 to ± 400.00 in H_20
0 to ± 100.00 kilopascal
0 to ± 30.000 in Hg
0 to ± 1000.0 in H_20

3.5.1.1 System Accuracy. The PLPC shall have a system accuracy which includes linearity, hysteresis and repeatability that meets the following requirements.

a. 0 to + 30″ Hg
   0 to + 400 H_20 ± 0.1% of reading + l digit
   0 to + kilopascals
b. 0 to -30″ Hg
   0 to -400″ H_20 ± 0.25% of reading + 1 digit
   0 to -100 kilopascals
c. 0 to + 100 psig ± 0.15% of reading + 1 digit
   0 to 1000. in H_20 ± 0.15% of reading + 1 digit

3.5.1.2 Pressure Resolution. The PLPC shall meet the following minimum resolution requirements.

Range	Resolution
0 to + 100 psig	0.01 psig
0 to ± 400 in. H_20	0.01 in. H_20
0 to ± 100 kp.	0.01 kp.
0 to ± 30 in. Hg	0.001 in. Hg

3.5.2 Pressure Decay. Pressure decay shall not exceed 1% of the set pressure over a period of one hour throughout each full scale range of the PLPC.

3.6 Operating Requirements. The PLPC shall provide the following capabilities.

3.6.1 Component Parts. The PLPC shall be housed in the following two enclosures: the Control Unit and the Pressure/Vacuum Supply Unit.

3.6.1.1 Control Unit. The PLPC control unit shall consist of the digital indicator w/signal conditioner, the electrical controls, and the pressure controls.

3.6.1.1.1 Pressure Sensor. The PLPC control unit shall contain a pressure sensor equivalent to the Datametrics, Barocel 572D-100P-23-V1, with Thermal Base 525.

3.6.2 Pressure/Vacuum Supply Unit. The PLPC pressure/vacuum supply unit shall consist of a pressure/vacuum pump, hose assemblies, test gage adapter kit, and fluid isolator.

3.6.3 Operating Controls.

3.6.3.1 Power On. The PLPC shall have a power on switch with a fuse available from front panel.

3.6.3.2 Range. The PLPC shall have a Five position rotary switch, which indicates available full scale pressure ranges of:

a. 400 inch H_20
b. 30 inch Hg.
c. 100 kilopascal
d. 100 psig
e. 1000 inch H_20

3.6.3.3 Zero Control. The PLPC shall have a zero control that sets the digital meter to zero when no pressure is applied.

3.6.3.4 Full Scale Check. The PLPC shall have a full scale check feature that activates the internal calibration voltages.

3.6.3.5 Full Scale Adjust. The PLPC shall have a full scale adjust control that adjusts each range to exactly full scale as required by internal calibration voltages per item 3.6.3.2 above.

3.6.3.6 Pressure/Vacuum Selector. The PLPC shall have a pressure/vacuum selector control that controls a two position valve which connects the proper internal pressure standard port to the system.

3.6.3.7 Vent Control. The PLPC shall have a vent control which is a metering valve that will return the system pressure to ambient atmospheric pressure in a carefully controlled manner.

3.6.3.8 Rapid Vent. The PLPC shall have a rapid vent control which consists of a toggle valve to allow rapid return of system pressure to ambient atmospheric pressure.

3.6.3.9 Pressure/Vacuum Control. The PLPC shall have pressure/vacuum control valve to control pressure to the PLPC sensor and the test port.

3.6.3.10 Pressure/Vacuum Vernier Adjust. The PLPC shall have pressure/vacuum vernier adjust control which consists of an adjustable closed volume to provide fine adjustment of pressure after the pressure/vacuum control valve has been closed.

3.6.3.11 Test Port. The PLPC shall have a test port with a female quick disconnect pressure fitting to which a variety of pressure fittings can be mated to allow easy connection to a test gage.

3.6.3.12 Pressure/Vacuum Supply Port. The PLPC shall have a pressure/vacuum supply port with a female quick disconnect pressure fitting to which an external source of pressure will be connected.

3.6.3.13 Electrical Output. An electrical connector(s) shall be provided with the following full scale analog outputs for external data recording systems.

a. 0 to ± 4.0000 VDC for 0 to ± 400.00 in H_20
b. 0 to ± 1.0000 VDC for 0 to ± 100.00 kilopascal
c. 0 to + 1.0000 VDC for 0 to + 100.00 psid
d. 0 to ± 3.0000 VDC for 0 to ± 30.00 in H_20

3.7 Design Requirements. The PLPC shall be supplied as a complete system ready for immediate operation when received.

3.7.1 Major Assemblies. Two major assemblies each packaged in identical carrying cases shall meet the following requirements for a ruggedized equipment case and there shall be no holes or openings when the covers are in place.

3.7.2 Carrying Case Size and Weight. Maximum case size shall not exceed 15 x 14.5 x 9.5 inches. One case shall contain the control unit and the other shall contain the pressure/vacuum supply unit. Neither case shall exceed 35 pounds when fully loaded.

3.7.3 Pressure/Vacuum Pump. The pressure/vacuum pump shall be a Gast Manufacturing Corporation Model 2HBC-10-M200X, rated at -27 in. Hg to + 100 psig, or equal.

3.7.4 Hoses, Supply and Test. All hoses shall meet the following minimal requirements: Minimum bend radius shall not exceed three inches. Minimum burst pressure: 400 psig. Safe working pressure: 100 psig. Proof pressure: 1 1/2 times the safe working pressure. Each hose shall be labeled to show the pressure medium, part number, burst pressure, and safe working pressure. All hoses shall be stored in either of the two case assemblies.

a. Supply Hose: One supply hose, 5 ft. in length. Shall mate with the pressure and vacuum connectors on the pressure/vacuum pump, the other end shall have a right angle fitting or adapter to mate with the control unit supply connector.

b. Pneumatic Test Hose: Two pneumatic test hoses shall be provided, one five feet long, and one 10 feet long. One end of each shall mate with the output connector of the control unit, the other end shall mate with the input connector to the fluid isolator and to the probe ends of the adapters listed in 3.7.5. Both hoses shall be capable of being connected in series either directly or through a mating adapter.

c. Hydraulic Test Hose: Two hydraulic test hoses shall be provided, one five feet long, and one 10 feet long. Both hoses shall be either clear or translucent, and one end of each hose shall mate with the output connector of the fluid isolator, the other ends shall mate with the probe ends of the adapters listed in 3.7.5. Both hoses shall be capable of being connected in series, either directly or through a mating adapter. The input connectors of these hoses must not be usable on the pressure test connector of the control unit.

3.7.5 Adapters. One set of adapters must be furnished in a compact durable case assembly which may be stored in either of the two major case assemblies. The set of adapters shall consist, as a minimum, the following items.

a. 1/8-27 Male NPT to QD probe
b. 1/4-18 Male NPT to QD probe
c. 3/8-18 Male NPT to QD probe
d. 1/2-14 Male NPT to QD probe
e. 1/8-27 Female NPT to QD probe
f. 1/4-18 Female NPT to QD probe
g. 3/8-18 Female NPT to QD probe
h. 1/2-14 Female NPT to QD probe
i. AND 10056-4 to QD probe
j. MIL-I-18997 Pressure Fitting to QD probe
k. 1/4 Female AN Swivel to QD probe
l. Hydraulic to Pneumatic

3.7.6 Fluid Isolator. One fluid isolator shall be provided in the pressure/vacuum pump case assembly. This unit will provide protection for the control unit, from hydraulic fluids, during hydraulic gage calibration, which may contaminate the pressure sensor. The pressure input connector shall mate with the output connector of the pneumatic test hose and the pressure output connector shall mate with the pressure input connector of the hydraulic test hose.

3.8 Manual. At least two copies of an operation and maintenance manual shall be provided. The manual shall meet the requirements of MIL-M-7298.

3.8.1 Calibration Procedure. A calibration procedure in accordance with MIL-M-38793 shall be provided.